



- 16 A statistician collected the following data to explore the relationship between two variables, x and y .

| x | y |
|-----|------|
| 2.3 | 11.0 |
| 4.2 | 16.5 |
| 5.1 | 19.2 |
| 6.4 | 23.1 |
| 8.2 | 24.3 |
| 8.5 | 29.5 |

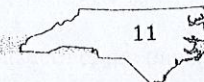
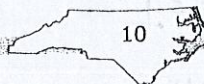
ORIGINAL
 $y = 2.63x + 5.4$

The statistician performed a linear regression and also plotted the residuals.

- Based on the residual plot, the statistician decided to exclude one data point.
- The statistician then performed linear regression on the set of remaining data points.
- The result was that the new linear model fit the remaining data more closely than the original model fit the original data.

Which data point did the statistician exclude?

- A (2.3, 11.0) $y = 2.5x + 6.29$
- B (4.2, 16.5) $y = 2.63x + 5.34$
- C (6.4, 23.1) $y = 2.61x + 5.33$
- D (8.2, 24.3) $y = 2.98x + 4.03$



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- 17 A set of nine data points is shown below.

8, 11, 12, 10, 9, 7, 5, 3, 9

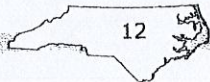
Which statement is true if a tenth data point of 45 is added to the data set?

- A The mean and median will both increase.
- B The mean will increase and the median will decrease.
- C The mean will increase and the median will remain the same.
- D The mean and median will both decrease.

mean = average
median = middle #

if you add another number mean will increase

Your calculator will give the same median both times



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Questions 18 and 19 are gridded response items that require you to write your answers in the boxes provided on your answer sheet. Write only one number or symbol in each box and fill in the circle in each column that matches what you have printed. Fill in only one circle in each column.

- 18 What is the distance, in units, between the y-intercept of $f(x) = x^2 + 7x - 18$ and the y-intercept of the linear function that passes through the points shown in the table below?

| x | g(x) |
|----|------|
| -5 | 2 |
| 10 | 11 |
| 25 | 20 |
| 60 | 41 |

y-int = -18
y-int = 5
Distance = 23

Find y-int of table

$$m = \frac{11-2}{10-(-5)} = \frac{9}{15} \Rightarrow a = \frac{9}{15}(-5) + b \Rightarrow b = 5$$

- 19 What is the value of x in the equation shown below?

$$2(x + 8) - 4x = 10x + 4$$

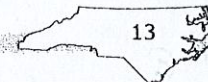
Solve for x

$$2x + 16 - 4x = 10x + 4$$

$$-2x + 16 = 10x + 4$$

$$\frac{12}{12} = \frac{12x}{12}$$

$$1 = x$$



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20 This is a paper/pencil copy of an online technology enhanced item.

Three systems of equations are shown in the table below.

Place (click and drag) the choice that describes the number of solutions of each system into the appropriate column in the table below.

| | | | |
|----------------|----------------|----------------|---------------------------|
| $2x + 2y = 16$ | $2x + 2y = 8$ | $4x + 3y = 27$ | one solution |
| $2x + 3y = 12$ | $2x + 4y = 16$ | $2x + 3y = 18$ | no solution |
| $2x + 2y = 16$ | $2x + 2y = 8$ | $2x + 3y = 12$ | infinitely many solutions |
| $2x + 2y = 16$ | $2x + 2y = 8$ | $2x + 3y = 12$ | one solution |
| $4x + 3y = 27$ | $2x + 4y = 16$ | $2x + 3y = 18$ | no solution |
| $2x + 2y = 16$ | $2x + 2y = 8$ | $2x + 3y = 12$ | infinitely many solutions |

21 Which equation represents the line that is perpendicular to the graph of $4x + 3y = 9$ and passes through $(-2, 3)$?

- A $3x - 4y = -18$
- B $3x + 4y = 18$
- C $3x - 4y = -6$
- D $3x + 4y = 6$

$y = \frac{3}{4}x + \frac{9}{2}$

perpendicular has opp reciprocal slopes

find original slope $y = -\frac{3}{4}x + 3$

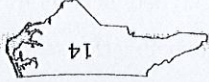
new slope $\frac{4}{3} = m$

$y = mx + b$

$3 = \frac{4}{3}(-2) + b$

$\frac{9}{3} = b$

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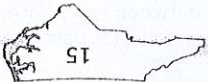


22 A club began with 3 members. Each month, each member brought one new member. Which function can be used to determine the number of members x months after the club began?

- A $f(x) = 2x + 3$
- B $f(x) = 3x + 1$
- C $f(x) = 1.5(2)^x$
- D $f(x) = 3(2)^x$

3 is initial amount
exponential $y = a(b)^x$

Go to the next page.





Questions 23 through 25 are gridded response items that require you to write your answers in the boxes provided on your answer sheet. Write only one number or symbol in each box and fill in the circle in each column that matches what you have printed. Fill in only one circle in each column.

- 23 Every ten years, the Census counts how many people are living in every town in the United States.
- The 2010 Census showed that 1,000 people were living in Appleville, and 4,000 people were living in Bridgetown.
 - The population of Appleville is predicted to double every ten years.
 - The population of Bridgetown is predicted to increase by 1,000 every ten years.

If the predictions come true, what will be the first census year that will show Appleville with a larger population than Bridgetown?

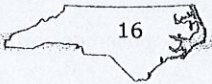
Appleville $y = 1000(2)^x$
 Bridgetown $y = 1000x + 4000$

plug into calculator
 Year 2040

- 24 Two stores have movies to rent.
- The first store charges a \$12.50-per-month membership fee plus \$1.50 per movie rented.
 - The second store has no membership fee but charges \$3.50 per movie rented.

What is the minimum number of movies a person would need to rent in a month for the first store to be a better deal?

1st store $1.5x + 12.50$
 2nd store $3.5x$
 $1.5x + 12.50 = 3.5x$
 $x = 6.25$



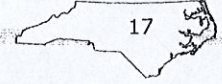
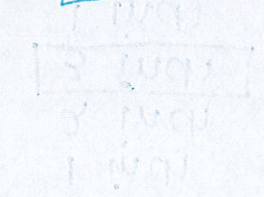
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- 25 Karen has two dogs. The larger dog weighs 1.4 pounds more than the smaller dog. The combined weight of the two dogs is 12.6 pounds. What is the weight, in pounds, of the smaller dog?

small = w
 Large = $w + 1.4$

$w + w + 1.4 = 12.6$
 $2w + 1.4 = 12.6$
 $2w = 11.2$
 $w = 5.6$



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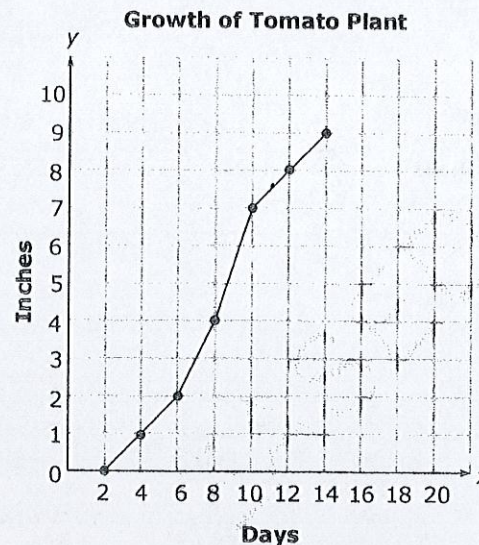
- 26 Which choice could be modeled by a linear function?
- A the amount of money, y , in an account after x years earning 4% interest compounded annually
 - B** the monthly cost, y , to use a cell phone for x minutes at a rate of 4 cents per minute
 - C the height, y , of a ball after bouncing x times, if each bounce reaches $\frac{2}{3}$ the previous height
 - D the amount, y , of radioactive material remaining after x years when decay occurs at a rate of 30% each year

Rate per minute \Rightarrow slope

A & D are exponential
C is quadratic



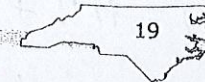
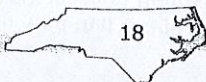
- 27 Oscar planted a tomato seed in his garden. Each day he recorded the height of the tomato plant.



During which interval did the tomato plant grow the fastest?

- A Day 4 to Day 6
- B Day 6 to Day 8
- C** Day 8 to Day 10
- D Day 10 to Day 12

1 inch
2 inch
3 inch
1 inch





Questions 28 and 29 are gridded response items that require you to write your answers in the boxes provided on your answer sheet. Write only one number or symbol in each box and fill in the circle in each column that matches what you have printed. Fill in only one circle in each column.

- 28 The function $a(n) = 3n - 7$ represents the value of the n th term in a sequence. What is the sum of the 1st and 5th terms of the sequence?

$n=1 \quad 3(1)-7 = -4$
 $n=5 \quad 3(5)-7 = 8$
 Sum
 $8-4 = 4$

- 29 The width of a rectangle is $\frac{3}{4}$ its length. The perimeter of the rectangle is 420 ft. What is the length, in feet, of the rectangle?

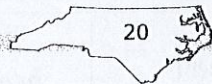
$W = \frac{3}{4}L$
 $L = L$
 Perimeter = add all sides

$2(\frac{3}{4}L) + 2L = 420$

$\frac{3}{2}L + 2L = 420$

$\frac{7}{2}L = 420$

$L = 120$



- 30 This is a paper/pencil copy of an online technology enhanced item.

Two functions are shown below.

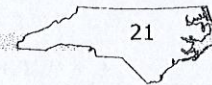
$f(x) = 3x^2 + 14x - 5$

$g(x) = 11x + 13$

Select (click) the points at which the graphs of the two functions intersect.

$(-5, 0)$ $(-3, -20)$ $(2, 35)$ $(6, 79)$

put in calculator $y =$ button
 2nd and graph buttons
 Check table to see what
 Coordinates are listed



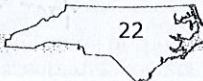


- 31 The table below shows the U.S. average life expectancy at birth, in years, in various decades.

| Years since 1930 | Life Expectancy at Birth |
|------------------|--------------------------|
| 10 | 62.9 |
| 20 | 68.2 |
| 30 | 69.7 |
| 40 | 70.8 |
| 50 | 73.7 |
| 60 | 75.4 |
| 70 | 77.0 |
| 80 | 78.7 |

What is the meaning of the slope of the linear best-fit equation for the data?

- A The predicted average life expectancy at birth in 1930 was about 62.7 years.
- B The predicted average life expectancy at birth in 1930 was about 57.6 years.
- C The average life expectancy at birth increases by about 6.7 each year.
- D The average life expectancy at birth increases by about 0.2 each year.



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- 32 The choices below are data sets. In the choices, w is a constant. Each choice has the same mean. Which choice has the greatest standard deviation?

- A $w - 2, w - 1, w, w + 1, w + 2$
- B $w - 2, w - 2, w, w + 2, w + 2$
- C $w - 3, w - 1, w, w + 1, w + 3$
- D $w - 3, w, w, w, w + 3$

- 33 Abby scored 87, 93, 96, and 89 on her first four history quizzes. What score does Abby need to get on her fifth quiz to have an average of exactly 91 on her history quizzes?

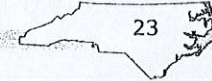
- A 90
- B 94
- C 98
- D 100

$$\frac{87 + 93 + 96 + 89 + x}{5} = 91$$

$$365 + x = 455$$

$$x = 90$$

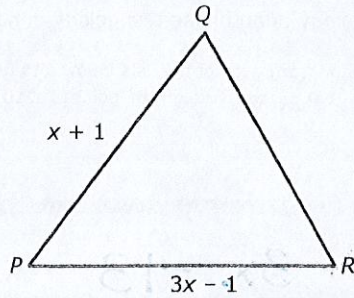
$$x = 90$$



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34 The perimeter of the triangle below is $8x - 6$.



Which expression represents the length of \overline{QR} ?

- A $4x - 4$
- B $4x - 6$
- C $6x - 4$
- D $6x - 8$

$$3x - 1 + x + 1 = 8x - 6$$

$$4x = 8x - 6$$

$$0 = 4x - 6$$

35 What are the solutions to the equation $4x^2 - 52x + 169 = 121$?

- A $\{1, -12\}$
- B $\{-1, 12\}$
- C $\{-1, -12\}$
- D $\{1, 12\}$

$$\begin{array}{r} 12 \\ -12 \times -1 \\ -13 \end{array}$$

Set equation equal to zero

$$4x^2 - 52x + 48 = 0$$

GCF $4(x^2 - 13x + 12) = 0$

$$4(x - 12)(x - 1) = 0$$

$$x - 12 = 0 \quad x - 1 = 0$$

$$x = 12 \quad x = 1$$

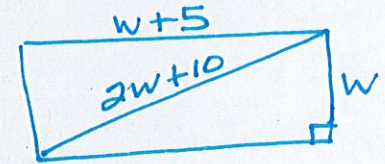


36 David has a rectangle and a right triangle.

- The length of the rectangle is 5 more than its width, w .
- The length of the shorter leg of the triangle is equal to the rectangle's width.
- The length of the longer leg of the triangle is twice the length of the rectangle.

Which function, $f(w)$, represents the combined area of the rectangle and the triangle?

- A $f(w) = 2w^2 + 10w$
- B $f(w) = 3w^2 + 15w$
- C $f(w) = w^2 + 10w + 25$
- D $f(w) = w^2 + 15w + 50$



$w = \text{width}$
 $w + 5 = \text{length}$

$$A = L \cdot W = (2w + 10)(w)$$

$$A = 2w^2 + 10w$$



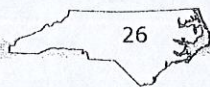
- 37 The table below shows the number of hours 7 students studied for a math test and the grade each student earned on the test.

| Student | Hours Studied (x) | Test Grade (y) |
|----------|-------------------|----------------|
| Mary | 2.00 | 84 |
| Jonathan | 1.75 | 86 |
| Susan | 2.00 | 88 |
| Terry | 3.00 | 94 |
| Patrick | 3.50 | 95 |
| Amanda | 3.50 | 93 |
| Darius | 2.25 | 89 |

How does Amanda's test score compare to the score predicted using the linear best-fit model of data for a student who studied 3.50 hours?

- A Amanda scored about 5 points lower than the score predicted for a student who studied 3.50 hours.
- B Amanda scored about 5 points higher than the score predicted for a student who studied 3.50 hours.
- C Amanda scored about 2 points lower than the score predicted for a student who studied 3.50 hours.
- D Amanda scored about 2 points higher than the score predicted for a student who studied 3.50 hours.

Look in table → find other student w/ 3.5 hrs → 95 test grade
Amanda has 93 → 2 pts Lower



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- 38 This is a paper/pencil copy of an online technology enhanced item.

Place (click and drag) one option from each of the lists below into its corresponding box to create an equation of the line that passes through the point (1, -10) and is perpendicular to $y = -\frac{1}{3}x + 5$.

$y =$

$3x - 13$

| | | |
|-----------------|---|----|
| 1 | 2 | 3 |
| $-\frac{1}{3}x$ | + | 1 |
| $-\frac{1}{5}x$ | - | 5 |
| $3x$ | | 10 |
| $5x$ | | 13 |

perpendicular has opp reciprocal slopes
new slope $m = 3$
 $y = mx + b$
 $-10 = 3(1) + b$
 $-13 = b$

- 39 Two functions are shown below.

$f(x) = 3x + 7$

$g(x) = 2x + 12$

What is the value of x where the graphs of f(x) and g(x) intersect?

- A -22
- B -5
- C 5
- D 22

$3x + 7 = 2x + 12$

$x = 5$



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- 40 Marcus measured the height, in inches, y , of plants over the course of 3 weeks. The correlation coefficient between the number of days, x , and the height of the plants is 0.85. Which could be concluded based on the correlation coefficient of the data?

- A There is a strong relationship showing that as the number of days increases, the height of the plants increases.
- B There is a strong relationship showing that as the number of days increases, the height of the plants decreases.
- C There is a weak relationship showing that as the number of days increases, the height of the plants increases.
- D There is a weak relationship showing that as the number of days increases, the height of the plants decreases.

is correlation coefficient
0.9 ↑ ??

strong means that both are
increasing



Question 41 is a gridded response item that requires you to write your answer in the boxes provided on your answer sheet. Write only one number or symbol in each box and fill in the circle in each column that matches what you have printed. Fill in only one circle in each column.

- 41 A function is shown below.

$$g(x) = 19.60 + 1.74x$$

What is the value of $g(30)$?

Substitute value $x = 30$

$$g(30) = 19.60 + 1.74(30)$$

$$g(30) = 71.8$$

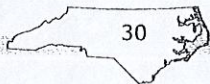


42 The table below shows the weights of 8 different bears at a zoo.

| Type of Bear | Weight (pounds) |
|--------------------|-----------------|
| Asiatic Black Bear | 225 |
| Black Bear | 300 |
| Brown Bear | 550 |
| Panda Bear | 200 |
| Polar Bear | 1,000 |
| Sloth Bear | 300 |
| Spectacled Bear | 280 |
| Sun Bear | 100 |

If the weight of the polar bear is removed, which statement is true?

- A The mean decreases more than the median because the polar bear is a high outlier.
- B The mean decreases less than the median because the polar bear is a high outlier.
- C The mean decreases more than the median because the high value balances the low value.
- D The mean decreases less than the median because the high value balances the low value.



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43 The vertices of a rectangle are located at $(1, 2)$, $(5, 0)$, $(2, -6)$, and $(-2, -4)$. What is the area of the rectangle?

- A 20 square units
- B 30 square units
- C 35 square units
- D 45 square units

44 This is a paper/pencil copy of an online technology enhanced item.

Select (click) each situation that can be modeled with a linear function.

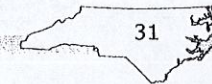
A taxi charges an initial fee of \$2.00, and \$1.50 for each additional mile.

The population in a town decreases by 15% each year.

An airplane flying at an altitude of 33,000 feet descends at a rate 20 feet per minute.

A pizza restaurant charges \$5.50 per pizza, and \$0.50 for each additional topping.

A cell doubles in size every 2 hours.



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- 45 What is the distance between the y -intercept of the function $f(x) = 2x^2 - 6x + 3$ and the y -intercept of the linear function g represented by the table below?

| x | $g(x)$ |
|-----|--------|
| -5 | 15 |
| -2 | 3 |
| 2 | -13 |
| 5 | -25 |

- A 2 units
 B 3 units
 C 8 units
 D 9 units

find y -int of table

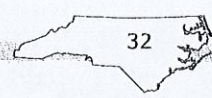
$$m = \frac{15 - 3}{-5 - (-2)} = \frac{12}{-3} = -4$$

$$15 = -4(-5) + b$$

$$-5 = b$$

distance = 8

$(-5, 15) = \text{triangle}$
 $(0, -5) = \text{triangle}$



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- 46 The table below displays the walking heart rate and running heart rate of eight girls in beats per minute (bpm).

| Walking Heart Rate | Running Heart Rate |
|--------------------|--------------------|
| 66 | 128 |
| 72 | 136 |
| 74 | 134 |
| 78 | 138 |
| 80 | 142 |
| 84 | 146 |
| 86 | 148 |
| 88 | 152 |

Using the linear best-fit model for the data, what is the predicted running heart rate of a girl whose walking heart rate is 100 bpm?

- A 161 bpm
 B 163 bpm
 C 165 bpm
 D 167 bpm

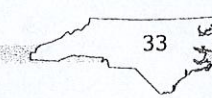
STAT Button
 Find Linear Regression

$$y = 1.04x + 58.84$$

$$x = 100$$

$$y = 1.04(100) + 58.84$$

$$y = 162.84$$



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47 This is a paper/pencil copy of an online technology enhanced item.

Place (click and drag) the data sets below into the appropriate rows in the table.

| | |
|--------------------------|---|
| Symmetric about the Mean | B |
| Skewed Left | C |
| Skewed Right | A |

| | |
|---------------------------|----------------------------|
| A 15, 25, 35, 45, 55, 115 | 15, 75, 85, 95, 105, 115 C |
| B 15, 25, 35, 45, 55, 65 | |



48 A rectangle has a perimeter of 64.

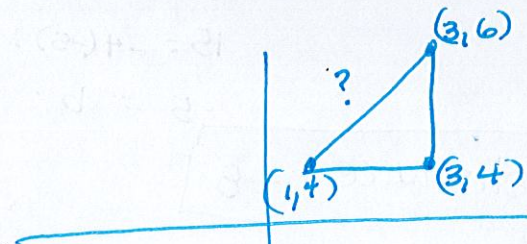
- Let x equal the width of the rectangle.
- Let y equal the area of the rectangle.

Which equation can be used to find the area of the rectangle?

- A $y = x^2 - 64x$
- B $y = -x^2 + 64x$
- C $y = x^2 - 32x$
- D $y = -x^2 + 32x$

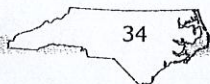
49 What is the midpoint of the longest side of the triangle with vertices $(1, 4)$, $(3, 4)$, and $(3, 6)$?

- A $(1, 1)$
- B $(2, 4)$
- C $(2, 5)$
- D $(3, 5)$

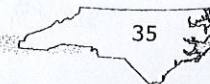


$$\text{Midpoint} = \left(\frac{3+1}{2}, \frac{6+4}{2} \right)$$

$$\text{Midpoint} = (2, 5)$$



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